SUMMARIES OF PRE-CAMBRIAN LITERATURE OF NORTH AMERICA FOR 1909, 1910, 1911, AND PART OF 1912

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II. EASTERN PART OF NORTH AMERICA

Miss Bascom[1] states that the oldest rocks of the Philadelphia district are the Baltimore gneiss and the Wissahickon mica gneiss. Their relation to each other is uncertain. Both are intruded by granites and gabbros.

The Baltimore gneiss presents a granitic and a gneissic phase. The latter consists of alternating, fine-grained layers of mica, quartz, and feldspar. The granitic variety contains quartz, feldspar, and accessories of biotite, hornblende, and garnets. The alternation of layers in the gneiss is regarded by Miss Bascom as evidence of sedimentary origin.

Miss Bascom believes that the Baltimore gneiss is approximately of the same age as the Fordham gneiss of New York, the Stamford gneiss of New England, and the Carolina gneiss of Virginia.

The pre-Cambrian rocks of the Trenton, N.J., district as described by Miss Bascom[2] consist of Baltimore gneiss and the Wissahickon mica gneiss, both of which she regards as of sedimentary origin. Besides these, there are granitic and gabbroic instrusives.

Bastin[3] states that the Adirondack graphite deposits occur in schists of sedimentary origin. Two types of occurrence are recognized, one related to the dynamic metamorphism of carbonaceous

[1] *Philadelphia Folio*, U.S. Geological Survey Folio 162, 23 pp., 12 pls., sections, maps, illustrations, 1909.

[2] F. Bascom *et al.*, *Trenton Folio*, U.S.G.S. Folio 167, 24 pp., 4 pls., 3 figs., 1909.

[3] Edson S. Bastin, "Origin of Certain Adirondack Graphite Deposits," *Econ. Geol.*, V, No. 2 (1910), 134–57.

sediments of the sand clay type, the other to both dynamic and contact metamorphism.

Bayley[1] states that the pre-Cambrian of New Jersey consists essentially of three series of gneisses, sodic, potassic, and basic, respectively, accompanied by pegmatites, all intrusive into still older limestones, the Franklin limestone. The gneisses contain magnetite ores in form pod shaped, northeastward-pitching shoots having the same structural attitude as the gneisses, and are frequently offset by cross and longitudinal faults. The ores are titaniferous, and are associated with basic and alkaline silicates. The Franklin limestone also contains some magnetite ores. These are non-titaniferous, veinlike masses, associated with heavy lime silicates and calcite.

Cushing[2] *et al.* state that the pre-Cambrian succession of the Thousand Islands' region may be classified, beginning with the oldest, as: (1) Grenville metamorphosed sediments, consisting of marbles, schists, gneisses, quartzites which originally were sandstones, shales, and limestones; (2) granite gneisses intrusive into the Grenville, and which have changed the Grenville into amphibolites along the contacts; (3) small bodies of massive syenite, gabbro, and granite; (4) unmetamorphosed basic dikes.

This region shows less complexity of folding, a greater dominance of acid intrusives, and fewer basic igneous rocks than the northern Adirondacks. It is regarded as a transition between the Adirondacks and the Grenville area of Canada.

Dale and Gregory[3] state that the Becket granite gneiss of probably pre-Cambrian age outcrops over wide areas in northern Litchfield county, Connecticut.

Emmons and Laney[4] state that the pre-Cambrian in the Ducktown district consists of the Carolina gneiss, a series of gneisses

[1] W. S. Bayley, "Iron Mines and Mining in New Jersey," *Geol. Survey of New Jersey*, Vol. VII, 499 pp., 23 pls., 2 maps, 31 figs.

[2] H. P. Cushing, H. L. Fairchild, R. Ruedmann, and C. H. Smith, Jr., "Geology of the Thousand Islands' Region," *New York State Mus. Bull.* 145, 194 pp., 63 pls., 6 maps, 9 figs., 1910.

[3] T. Nelson Dale and Herbert E. Gregory, "The Granites of Connecticut," *Bull. 484, U.S. Geological Survey*, 1911. Several maps.

[4] W. H. Emmons and F. B. Laney, "Preliminary Report on the Mineral Deposits of Ducktown, Tennessee," *Bull. 470, U.S. Geological Survey*, 1910.

which probably were developed from the metamorphism of granites, and other igneous rocks and possibly some sediments. It is associated with and probably intruded by the Roan gneiss, which seems to have been diorite and gabbro mainly. Both the Carolina and Roan gneiss are intruded by a younger, less altered granite.

Gordon[1] states that one of the major stratigraphic problems of eastern North America is the separation of the pre-Cambrian from the early Paleozoic sediments and the subdivision of the pre-Cambrian. The problem is complicated by structural intricacy and metamorphism.

Gordon[2] reports that granitic hornblende and mica gneisses, quartzite, and basic eruptives of pre-Cambrian age are found within the Poughkeepsie quadrangle.

Kemp and Ruedemann[3] state that the pre-Cambrian rocks of the Elizabethtown and Port Henry quadrangles of the northwestern part of the Adirondack region may be classified in order of age from latest to the oldest as follows: (1) the unmetamorphosed basaltic dikes; (2) the eruptive complex of more or less metamorphosed granite, anorthosite, syenite, gabbros, and intermediate types; (3) the Grenville series of limestones, ophicalcites, schists, and sedimentary gneisses. The syenites contain lens or podlike bodies of nontitaniferous magnetite with apatite. The hanging wall is generally more acid than the footwall. Locally the gabbros consist dominantly of magnetite and ilmenite.

Kemp[4] summarizes the characteristics of the pre-Cambrian of New York and points out some of its striking similarities to the pre-Cambrian of Sweden.

The oldest pre-Cambrian rocks of the Adirondack are the Grenville sedimentary gneisses and schists, intruded by batholiths of granite gneisses. These were intensely folded and then intruded in the order of time by anorthosite, syenite, basic gabbros, and

[1] C. E. Gordon, "Some Geologic Problems," *Science*, N.S., XXIX (1909), 901–3.

[2] C. E. Gordon, "Progress Report on Poughkeepsie Quadrangle," *New York State Museum Bull. 140*, 1910, pp. 16–20.

[3] "Geology of the Elizabethtown and Port Henry Quadrangles," *New York State Museum Bull. 138*, 1910, 173 pp., 21 pls., 36 figs.

[4] J. F. Kemp, "Pre-Cambrian Formations in the State of New York," Congrès Géologie International, 1910, pp. 699–717.

basalt and porphyry dikes. At Mineville, the syenites are associated with magnetite ores, which in their phosphorus content and in the composition of their wall rocks resemble those of Kiruna. The intrusive episode was followed by intense folding and long-continued erosion. The Paleozoic rocks like those of Sweden were here deposited upon an undulating floor of moderate relief. In New York, evidences of old pre-Cambrian valleys filled by Paleozoics have been found. The visible contacts between the pre-Cambrian and the Paleozoic rocks in the Adirondacks as in Sweden are partly depositional and partly along faults.

The oldest pre-Cambrian rocks in the southeastern area of New York are the Fordham gneiss, consisting dominantly of sedimentary rocks intruded by granite batholiths. Kemp correlates the Fordham gneiss with the Grenville series on the basis of lithologic similarity, and identity of stratigraphic position. Above the Fordham gneiss lie the Manhattan schists and Inwood marble, both metamorphosed sedimentary formations, but less metamorphosed than the Fordham gneiss. They are intruded by plutonic rocks showing a wide range of composition which show parallelism to the Subjotnian of Sweden in their stratigraphic relations, but not in their petrographic characteristics. The Manhattan schists and Inwood limestones Kemp believes may be parallel to the Huronian of the Lake Superior region and the Jatulian of Sweden and Finland.

Kümmel[1] states that the pre-Cambrian rocks comprise a series of basic gneisses and limestones, which are cut by acid gneisses, and pegmatites, all of which lie unconformably beneath the Cambrian. The gneisses are nearly all mineralogically and chemically equivalent to basic and acid igneous rock types, and are largely, if not entirely of igneous origin. The acid intrusives present no evidence of crushing, which probably means that their foliation was developed during crystallization by deformative stresses. The limestones are associated with magnetite ores, and with the Franklin Furnace and Sterling Hill zinc ores. The present state of crystallization, and structural character of the rocks, as well as the develop-

[1] Henry B. Kümmel, "Geological Section of New Jersey," *Jour. Geol.*, XVII, No. 4 (1909), 351–80.

ment of ores, probably resulted from one brief period of deformation and intrusion.

Koeberlein[1] describes the Brewster district as a part of the pre-Cambrian area of New York City, about 54 miles to the northwest of the city. The abandoned Tilly Foster, Brewster, and Croton mines are located here. The stratigraphy from the bottom is reported as Fordham gneiss comprising three series, sedimentary, granitic, and syenitic, respectively, followed by the Inwood limestone and the Manhattan schists intruded by diorites and pegmatite.

The ores are titaniferous and non-titaniferous magnetites, closely related to the syenite of the Fordham gneiss. The syenite contains magnetite, apparently the last mineral to crystallize. The titaniferous magnetites are regarded as magmatic segregations. The non-titaniferous ore of the Tilly Foster mine is regarded as a replacement of limestone by solutions given off during the cooling of the syenite. The gangue consists of chondrodite, garnets, and other minerals characteristic of the deep-seated metamorphism of limestones.

W. J. Miller[2] states that the oldest rocks of the Remsen and Port Leyden Quadrangles of the southwestern part of the Adirondack Mountains are the Grenville sediments, originally sandstones, shales, and limestones which were altered to gneisses and crystalline limestones by syenite intrusions and complex folding, before Cambrian time.

Stose[3] states that the pre-Cambrian rocks of the Mercersburg-Chambersburg area of Pennsylvania consist of a series of altered basalt flows overlaid by altered, finely laminated, spherulitic, and porphyritic rhyolite lava.

Watson[4] reports that an insignificant tonnage of manganese ore has been mined in the crystalline schists of Georgia, which are at

[1] F. R. Koeberlein, "Brewster Iron-bearing District of New York," *Econ. Geol.*, IV (1909), 714–54.

[2] W. J. Miller, "Geology of the Remsen Quadrangle," *New York State Museum Bull. 126*, 1909, 51 pp., 11 pls., 4 figs., 1 geol. map; "Geology of the Port Leyden Quadrangle," *New York State Museum Bull. 135*, 1910, 61 pp., 5 figs.

[3] G. W. Stose, *Mercersburg-Chambersburg Folio*, U.S.G.S. Folio 170, 19 pp., 8 pls., 5 figs., 1909.

[4] Thomas L. Watson, "The Manganese Ore Deposits of Georgia," *Econ. Geol.*, IV (1909), 46-55.

least partly of pre-Cambrian age. Most of the ores occur in a residual clay derived from the decay of crystalline schists. The minerals composing the ores are generally oxides, but silicates are also represented, the latter being somewhat abundant in the undecayed rocks.

Woodman[1] states that the pre-Cambrian mountain protaxis of Cape Breton, Nova Scotia, is not well known. Certain iron-bearing dolomites called the George River limestone may be Upper pre-Cambrian.

[1] J. E. Woodman, "Report on the Iron Ore Deposits of Nova Scotia," *Canada Dept. of Mines*, 1909.

[*To be continued*]